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Response Under 37 C.F.R. 1.116
Expedited Procedure
Examining Group No.: 2613
Patent
Attorney's Docket No. 030681-152

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	**Mail Stop AF**
Euee-Seon JANG et al.	)	Group Art Unit: 2613
Application No.: 09/396,470	)	Examiner: B. Senfi
Filed: September, 15, 1999	)	Confirmation No.: 7479
For: METHOD OF PROGRESSIVELY CODING/DECODING 3-D MESH INFORMATION AND APPARATUS THEREOF	)	

REQUEST FOR RECONSIDERATION

Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

In response to the final Office Action dated July 29, 2003, Applicants respectfully request reconsideration and withdrawal of the rejection of the claims.

In the most recent Office Action, the rejections of all pending claims were maintained, as either being anticipated under 35 U.S.C. § 102(e) or unpatentable under 35 U.S.C. § 103(a), in view of the *Bajaj et al.* patent. The Action includes a section entitled "Response to Amendment,"at page 2, which states that the arguments presented by Applicant in the Amendment filed May 19, 2003, were not considered to be persuasive. This part of the Office Action, which includes statements directed only to claim 9, considers Applicants' arguments ineffective for the following reasons:

The Action asserts that "in the process of data compression and decompression, the redundant information being removed before transmission (to save bandwidth) and in the decoding side the data [sic], in which the redundant information has been already removed will be reconstructed ...." However, when specifically addressing claim 9, Applicants'

response argued why Examiner's allegation of obviousness with respect to removal of redundant information is not relevant to the claims, and why it appears logically incorrect. Specifically, Applicants' response contained the following statements:

> The undersigned does not understand the logic of this statement because the claimed feature pertains to a decoding step, and thus a decompression process. Applicants dispute any allegation that it would have been obvious to transmit an independently coded mesh object layer and remove redundant information in a decoding process, as evidenced from the Examiner's own statement regarding the removal of redundant data before compressing data. If the Examiner intends to maintain this rejection, it is respectfully requested that he provide a reference teaching the claimed combination including this feature. (Emphasis in original.)

(See, the May 19, 2003 Amendment, page 12.)

The new assertion expressed on page 2 of the final Office Action do not explain what logical connection exists between the claimed "removal of redundant information" and the assertion of reconstructing information when decoding, and why such a connection would have led one of ordinary skill in the art to the claimed invention. In contrast, the Examiner's statement appears contrary to claimed step of "(d) reconstructing the original 3-D mesh by collecting the independent mesh object layers and removing redundant information." That is, the Examiner's statement implies that reconstructing original information in a decoding process by restoring, or reinserting the information that was removed in a coding process would have suggested removal of this information. In contrast, claim 9 recites a step involving removing redundant information when reconstructing an original 3-D. The significance of this step becomes apparent when considering the preceding recited step: "(c) obtaining one or more independent mesh object layers by decoding one or more of the independently coded and transmitted mesh object layers." In other words, step (d) of claim 9 recites removing redundant information from collected independent mesh object layers, which are obtained in the decoding of step (c). It is respectfully submitted that the concept of removing redundant information at the time of collecting decoded one or more of independent mesh object layers is not taught or suggested in the *Bajaj et al.* patent.

The Finality of the Office Action is Premature

Applicants further note that the Office has not provided any reference that teaches this feature of "removing redundant information," as requested in Applicants' response. Instead, the latest assertions by the Office concerning "*Bajaj* 266 encoding/decoding also is a hierarchy process of layers, in which in the process of encoding/decoding the redundant information is being removed [sic]" appear to be alleging that removing redundant information is inherently disclosed in the *Bajaj et al.* patent. (See, the final Office Action, page 2, lines 12-13.) It is respectfully submitted that such a shift from a basis of obviousness to one of inherency would constitute a new ground of rejection. However, the only changes made to claim 9 consist of rewriting it in independent form. Hence, claim 9 has never been amended in response to any rejection. Applicants therefore submit that the finality of the Office Action is premature, and thus should be withdrawn, because the newly based rejection of claim 9 was necessitated by any amendment made to this claim.

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No Factual or Technical Reasoning Given for New Allegations of Inherency

Applicants submit that the new statement concerning the "hierarchy process of layers" is not based on any factual evidence or technical reasoning that would make it clear to one of ordinary skill in the art that any processes disclosed in *Bajaj et al.* inherently would require removal of redundant information in the step of reconstructing an original 3-D mesh, as claimed. MPEP § 2112 instructs that it is the burden of the Office to present any factual basis of inherency, *i.e.*, that the features alleged to be inherent are necessarily present in the *Bajaj et al.* patent. It is respectfully submitted that the Office Action does not provide a reasonable basis that the decoding process of *Bajaj et al.* inherently discloses the claimed step of reconstructing an original 3-D mesh by collecting decoded independent mesh object layers and removing redundant information.

It is further noted that the final Office Action alleges that the disclosure of a "synthesizer for synthesizing independent mesh object layers and removing redundant information to reconstruct an original 3-D mesh," at page 4, lines 19-20 of Applicants' specification, constitutes a "definition" of removing redundant information. It is not clear,

however, what definition the final Office Action is referring to in the cited portion of the specification. For a description of the concept of removing redundant information, the Examiner's attention is directed to the specification, page 8, line 29 to page 9, line; page 9, line 26 to page 10, line 6; page 10, lines 10-14 and lines 21-25; and page 11, lines 3-28; and Figures 6, 8, 11B, 12A and 12B. As described therein, a process of "removing redundant information" removes information that had been created in a processes of extracting independent mesh object layers and independently coding these layers. For instance, pages 8-11 of the specification disclose several exemplary embodiments of the present invention in which a mesh object is processed to produce independent mesh object layers (and/or independent mesh components), each of which may include extra information, such as repeated boundary information. Nowhere in Applicants' disclosure is "removing redundant information" described as it is characterized in the Office Action.

For at least these reasons, the Office has not established a *prima facie* case of obviousness. As such, the rejection of claim 9 should be withdrawn.

The *Bajaj et al.* Patent Does Not Teach Independent Mesh Object Layers

Claim 9 additionally recites the step of "(a) extracting one or more independent mesh object layers from a 3-D mesh." In connection with this subject matter, the Office Action alleges that Figures 1, 3a-3c and 10, and column 3, lines 60+ and column 6, lines 20-30 of the *Bajaj et al.* patent teaches "decomposing the bit streams into contours and dividing contours into plurality of mesh component [sic] ...." (See, the Office Action, page 4, lines 1-2 and lines 18-19, which reference the discussion of claim 10.) It is respectfully submitted, however, that the description in the cited portions of the *Bajaj et al.* patent of converting a given mesh into typical triangle strip structures by layer decomposition (as shown in Figure 3) and defining vertices as layers by their grouping into parent-child related contours (as shown in Figure 6) does not teach or suggest extracting one or more independent mesh object layers from a 3-D mesh, as claimed. Further, while the processes shown in Figure 10 of *Bajaj et al.* describe how to encode the vertices and the triangles, they do not disclose extracting independent mesh object layers as claimed.

An independent mesh object layer in the context of the present invention (1) does not depend on other layers for its reconstruction and (2) includes both connectivity and geometry components. The connectivity data of *Bajaj et al.*, by itself, is not an independent mesh object layer. Nor does geometry data alone define an independent mesh object layer. The *Bajaj et al.* patent does not appear to describe or suggest any type of grouping of connectivity data with the geometry data that would have suggested "extracting one or more independent mesh object layers," as set forth in claim 9.

Rather, the *Bajaj et al.* patent appears to describe encoding mesh geometry data by successively encoding the mesh vertices, all of which have a parent-child relationship amongst themselves (except for a first chosen root vertex, which does not have any parent vertex) (column 11, lines 7-29). *Bajaj et al.* also describes a parent-child relationship with respect to all contours of different vertex layers. Hence, the *Bajaj et al.* patent does not appear to suggest the claimed independent mesh object layers because in *Bajaj* every triangle strip is dependent on two adjacent vertex layers and each vertex layer would be necessary to decode two adjacent triangle layers. This dependence among layers appears to exist throughout the encoded mesh described in *Bajaj et al.*

Subject Matter of the *Bajaj et al.* Patent Not Supported in *Bajaj et al.* Provisional Application

Even if one were to assume, *arguendo*, that the *Bajaj et al.* patent somehow suggests "extracting one or more independent mesh object layers," it is respectfully submitted that such hypothetical suggestion would not be afforded the August 27, 1998 filing date of Provisional Application No. 60/098,150 (hereinafter, "the '150 priority document"). (For the Examiner's convenience, a copy of the '150 priority document is attached herewith.). As can be seen on page 84 of the '150 priority document, the "format of overall data stream of compressed mesh" (shown in table 6) first includes a header, then all the encoded mesh geometry data, and then all the encoded mesh connectivity data following the encoded geometry data. With respect to the geometry data of a mesh, the '150 priority document states that "vertices are encoded in a strict order" (see, the priority

document, page 87, line 1), and that each layer is encoded successively (*Id.*, at about line 17). The connectivity data following the geometry data is encoded consecutively, layer-by-layer (*Id.*, pages 91-92), with triangle strips associated with their respective child contours. (*Id.*, at pages 52 and 86.)

Applicants further submit that disclosure in the *Bajaj et al.* patent, column 1, lines 21-49, column 4, lines 3-5, column 6, lines 20-23, of subject matter relating to "error-resistant transmission and reception" of 3-D objects, "incremental" streaming modes, "packet corruption" in an "error-prone communication environment," the ability to "decode and display whatever information [the receiving party] has received from the server without retransmission," and "progressive incremental transmission" are not taught or suggested in the '150 priority document. The '150 priority document instead concentrates on attempting to improve efficiency in the encoding of connectivity, geometry data and multi-resolution meshes. It is not, however, concerned with solving problems addressed by the present invention, which include inefficiency problems related to error occurrences during transmission of mesh data, and incremental transmission and reproduction of independent mesh object layers. The conclusion of the '150 priority document, in fact, mentions that issues concerning treatment of lost packets during transmission should be considered for further work. (See, the '150 priority document, pages 69 and 82, especially page 82, lines 9-10.)

In contrast, the present invention is concerned with the fact that encoded mesh data is subject to damage or loss when transmitted in communication lines. As mentioned above, the '150 priority document does not address these problems, and more importantly, the '150 priority document does not disclose the features of the present invention of independent mesh object layers. For instance, the coding/decoding method of claim 9 includes a step of extracting one or more independent mesh object layers from a 3-D mesh and independently coding and transmitting each independent mesh object layer. For example, as described in the specification, at page 2, the division of a mesh model into independent mesh components allows for progressive picture reproduction in a step-like

manner, which allows for incremental build-up of the model by reproducing each independent component as soon as decoding of the component is complete.

The method of claim 9 additionally provides efficient ways to cope with transmission errors that are generated in a communication line. For instance, a decoder can build a model from transmitted independent mesh object layers that are not corrupted by the errors. In this case, a geometric model can be viewed despite instances in the displayed object of "holes" corresponding to lost data. In a case where it is necessary to retransmit mesh data that was damaged by a communication line error, the amount of retransmitted mesh data is minimized because only the damaged independent mesh object layer(s) need to be resent.

Because the '150 priority document does not discuss these concepts, it does not teach or suggest the claimed invention. Therefore, the August 27, 1998 filing date of the '105 priority document cannot be relied upon as a Section 102 date for any disclosure of these features that may exist in the *Bajaj et al.* patent.

The final Office Action also cites column 3, lines 60+, and column 6, lines 20-30 of the *Bajaj et al.* patent for disclosure of extracting one or more independent mesh object layers. As noted above, however, "progressive incremental transmission" is neither mentioned nor suggested in the '105 priority document. Hence, this subject matter is not afforded a Section 102 prior art date prior to the filing date of the *Bajaj et al.* patent. Furthermore, the description at column 4, lines 3-5 of *Bajaj et al.*: "The geometric primitives for the two basic kinds of contours, vertex and triangle, are encoded independently and alternately," also does not find support in the '150 priority document. Moreover, this description of "independent" and "alternate" encoding of vertex contours and triangle strips in the *Bajaj et al.* patent appears to be related only to connectivity data, and thus not to an independent mesh object layer. In any event, this disclosure in *Bajaj* occurs after both of Applicants' August 29, 1998 and March 20, 1999 priority dates. As such, this subject matter is not prior art under Section 102, and hence also under Section 103.

For at least the above reasons, the rejection of claim 9 should be withdrawn.

Independent claims 10 and 18-20 similarly recite combinations features that are not believed taught or suggested in the *Bajaj et al.* patent and the '150 priority document. For instance, claim 10 is directed to a method for progressively coding/decoding information of a 3-D mesh that includes, *inter alia*, a step of "extracting one or more mesh object layers from a 3-D mesh and dividing each of the mesh object layers into a plurality of independent mesh components." Claim 18 recites that a progressive 3-D mesh information coding/decoding apparatus includes a 3-D mesh object layer analyzer for receiving a 3-D mesh and dividing an input 3-D mesh into one or more independent mesh object layers. Claims 19 and 20 each recite, *inter alia*, a 3-D mesh object layer analyzer for receiving a 3-D mesh, dividing an input 3-D mesh into one or more mesh object layers, and again dividing each mesh object layer into a plurality of independent mesh components. Claims 18 and 20 also respectively recite a 3-D mesh object layer synthesizer and a 3-D step data synthesizer for removing redundant information to reconstruct an original 3-D mesh. For at least for the reasons given above with respect to claim 9, claims 10, 18 and 20 are patentable. Claim 11 depends from claim 10 and is therefore believed patentable at least for the above reasons, and further for the additional features recited.

Bajaj et al. Does Not Disclosure Unit Mesh Components Capable of Incremental Reproduction

In maintaining the rejection of claim 5, the final Office action again refers to Figures 1, 3a-3c and 10, and column 3, lines 60+, and column 6, lines 20-30 of the *Bajaj et al.* patent and asserts that these portions of *Bajaj et al.* teach the recited progressive 3-D mesh information decoding method that includes, *inter alia*, the step of "dividing a transmitted bit stream into a plurality of coded mesh components, wherein the plurality of mesh components are capable of being incrementally reproduced as unit mesh parts of a 3-D mesh." Applicants' remarks in the May 19, 2003 Amendment, however, pointed out why these features are not taught or suggested in the *Bajaj et al.* patent. Specifically, Applicants' response included the following statements:

> [W]hen the *Bajaj* patent describes "progressive, " it is either in the context of "progressive bit transmission" or "progressive connectivity transmission" (see the *Bajaj* patent, column 10, lines 62-65), both of which pertain to a *multi-resolution* reproduction of a 3-D mesh. For instance, in one technique described in columns 10-11 of the *Bajaj* patent, all the connectivity data is encoded at a first stage and not updated any further, while the geometry data is first represented in a coarse mesh level by transmitting the most significant bit, and in more detail by transmitting the bits of lower significance. The *Bajaj* patent also discloses a technique of progressive connectivity transmission which is used to first simplify a mesh to produce a coarse level mesh and data pertaining to the details of the original mesh lost in the simplification process. The coarse mesh is first transmitted, restored, and then refined by the details that are transmitted later. In particular, the *Bajaj* patent discloses alternately performing "intra-layer decomposition" and "inter-layer decomposition." As described in columns 12-13 of the *Bajaj* patent, intra-layer connectivity decomposition is a mesh simplification technique in which half of the vertices in each vertex layer are decimated (i.e., every other vertex in a vertex layer is removed). In inter-layer simplification stage, the decimation involves the elimination of a whole vertex layer and re-triangulating the space between contours which were adjacent to the decimated vertex layer. The details formed with each inter-layer and intra-layer simplification are transmitted after the coarse layer mesh is transmitted. (See the *Bajaj* patent, columns 9-13, and the abstract.).

(The May 19, 2003 Amendment, page 9, lines 2-22.) The response goes on to point out that the *Bajaj et al.* patent neither discloses, nor otherwise suggests, the features of progressive decoding in connection with progressive incremental reproduction of unit mesh parts. The final Office Action does not address these points of distinction that were brought out by Applicants. For at least these reasons, it is respectfully submitted that claim 5 is patentable over the *Bajaj et al.* patent.

Furthermore, it is respectfully submitted that the '105 priority document does not teach or suggest "dividing a transmitted bit stream into a plurality of coded mesh components, wherein the plurality of mesh components are capable of being incrementally reproduced as unit mesh parts of a 3-D mesh." As pointed out above, the '105 priority document does not provide support for much of the *Bajaj et al.* patent disclosure relied upon in the rejection. Moreover, the separation of geometry data from connectivity data in the bitstream of the '105 priority document does not teach or suggest that partitions of

mesh components are capable of incremental reproduction as unit mesh parts of a 3-D mesh.

In contrast, the unit mesh part recited in claim 5 are partitions of a 3-D mesh. They also are capable of being reproduced by a decoder, and thus include information necessary for their incremental reproduction. Further, because these mesh components are capable of being incrementally reproduced, the step reconstruction of the 3-D mesh involves an incremental build-up these unit mesh parts. Neither the *Bajaj et al.* patent nor the '101 priority document disclose this concept.

Even if one were to consider, *arguendo*, that the *Bajaj et al.* patent were to disclose the claimed step of dividing a transmitted bit stream into a plurality of mesh components capable of being incrementally reproduced as unit mesh parts of a 3-D mesh, the '105 priority document would fail to support such hypothetical disclosure in *Bajaj et al.*, for the above reasons. Hence, a Section 102 prior art date for such subject matter would be the actual August 26, 1999 filing date of the *Bajaj et al* patent and not the August 27, 1998 filing date of the '105 priority application.

For at least for these reasons, claim 5, and its dependent claims 6 and 7, are patentable.

Claim 15 is directed to a progressive 3-D mesh information decoding apparatus similarly recites combinations of features not taught or suggested in the applied prior art. For instance, claim 15 recites "a plurality of component decoders for decoding the plurality of coded mesh components, wherein the plurality of decoded mesh components are capable of being incrementally reproduced as unit mesh parts of a 3-D mesh." The feature of incremental reproduction as unit mesh parts are also brought out in the multiplexer recited in claim 12. Hence, for at least the above reasons, claims 12 and 15, as well as their dependent claims, are patentable over the applied prior art.

With respect to the Section 102 rejection, Applicants presented arguments spanning pages 9-11, which point out why the *Bajaj et al.* patent fails to anticipate claims 1 and 2. For instance, Applicants argued that "progressive," as disclosed in the *Bajaj et al.* patent is not the same as progressive coding of the present invention. Applicants also argued that

Figures 10 and 31 of the *Bajaj et al.* patent do not disclose the features of claim 2. The final Office Action, however, does not address any of these arguments.

With respect to claim 1, the Action, referring again to Figures 1, 3a-3c and 10, and column 3, lines 60+ and column 6, lines 20-30 of the *Bajaj et al.* patent, alleges that the *Bajaj et al.* patent teaches the claimed step of "coding each of the plurality of mesh components, wherein the plurality of coded mesh components are capable of being decoded and incrementally reproduced as unit mesh parts of the 3-D mesh." However, Figure 10 does not disclose these features for reasons discussed above with respect to claim 9 and for the reasons pointed out in the May 19, 2003 Amendment. While the description of Figure 1 at column 6, lines 20-23 discloses "progressive incremental transmission in accordance with another aspect of the invention, "progressive," as disclosed in the *Bajaj et al.* patent, is not the same as transmitted bit stream of mesh components capable of being decoded and incrementally reproduced as unit mesh parts, as recited in claim 1.

Furthermore, nowhere in *Bajaj et al.* is photometry data even mentioned, much less multiplexing mesh components into a bit stream in which each mesh component includes this information along with geometry and connectivity information, as recited in claim 2. As mentioned above, the *Bajaj et al.* patent does not disclose mesh components corresponding to different partitions of a 3-D mesh because *Bajaj et al.* does not disclose any type of division of a 3-D mesh object that would result in mesh components having the geometry and connectivity information needed for their reproduction.

For at least these reasons, it is respectfully submitted that the *Bajaj et al.* patent does not anticipate claims 1 and 2, and hence also dependent claims 3 and 4. It is further noted that much of the subject matter relied upon in the rejection are not disclosed in the '150 priority document. Accordingly, claims 1-4 are patentable.

The Final Office Action is Not Clear and Complete

It is respectfully submitted that the final Office Action is not complete because Applicants have presented numerous arguments and requests for further explanation that have neither been noted nor answered. See, 37 C.F.R. § 1.104 and MPEP § 707.07(f). If the rejection of any of the claims is maintained, the Examiner is requested to identify how that patent is being interpreted to suggest the specific distinguishing features discussed above and in the May 19, 2003 Amendment. In the absence of such a showing, it is respectfully submitted that the rejection should be withdrawn.

Respectfully submitted,

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